FLORIDA MASTER GARDENER

Soil, Plant Nutrients, and Fertilizer

UF | IFAS Extension
UNIVERSITY of FLORIDA

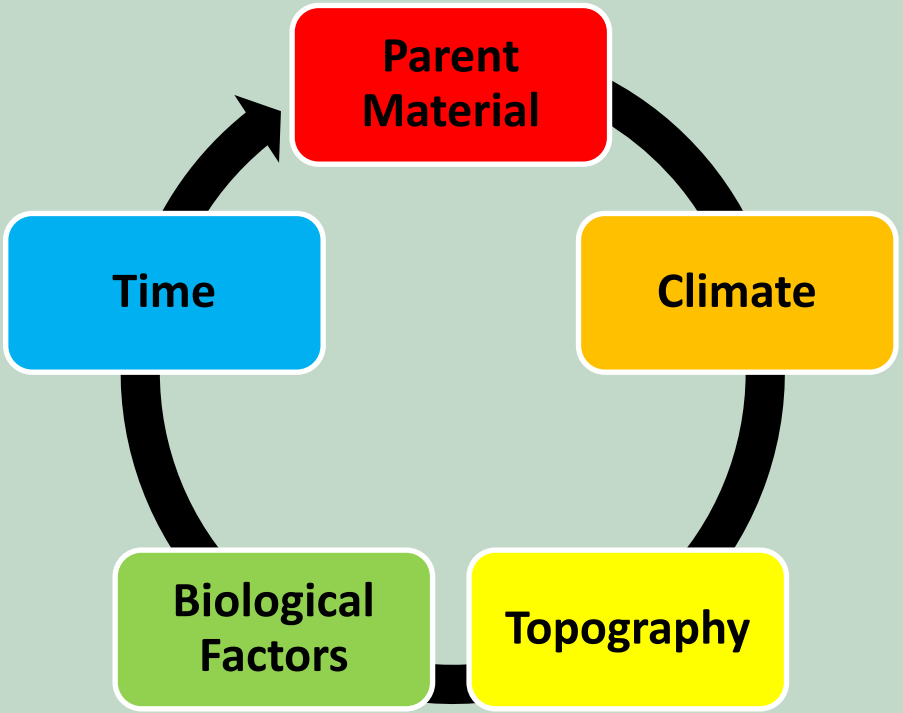
Part I - Soil

Learning Objectives:

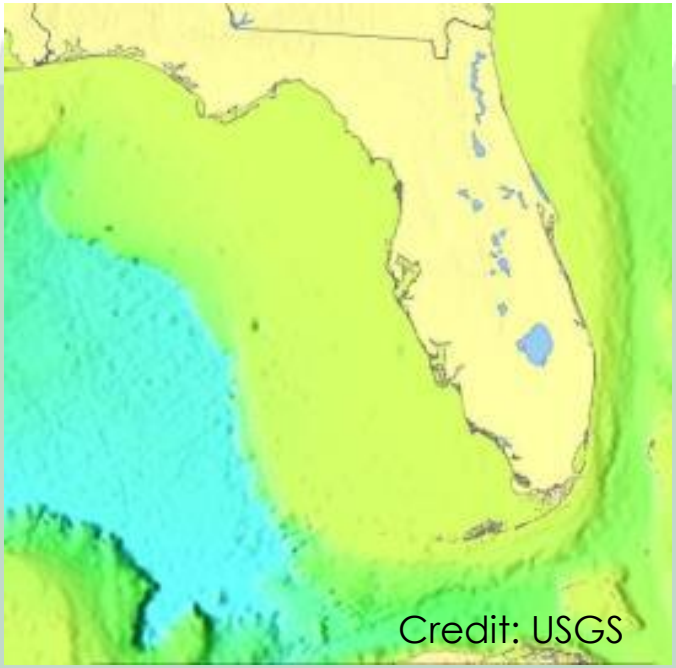
- Understand the origin and characteristics of Florida's soils.
- Define important soil terms:
  - Composition
  - Particle size
  - Texture
  - Pore space/Drainage
  - Fertility
  - Organic matter
  - pH
  - Salinity
- Discuss suitable pH ranges for general types of plants.
- Describe how to take a soil sample.

What is a Soil?

Soil: A composite of inorganic minerals, organic humus, living organisms, moisture, and air that forms on the land surface.

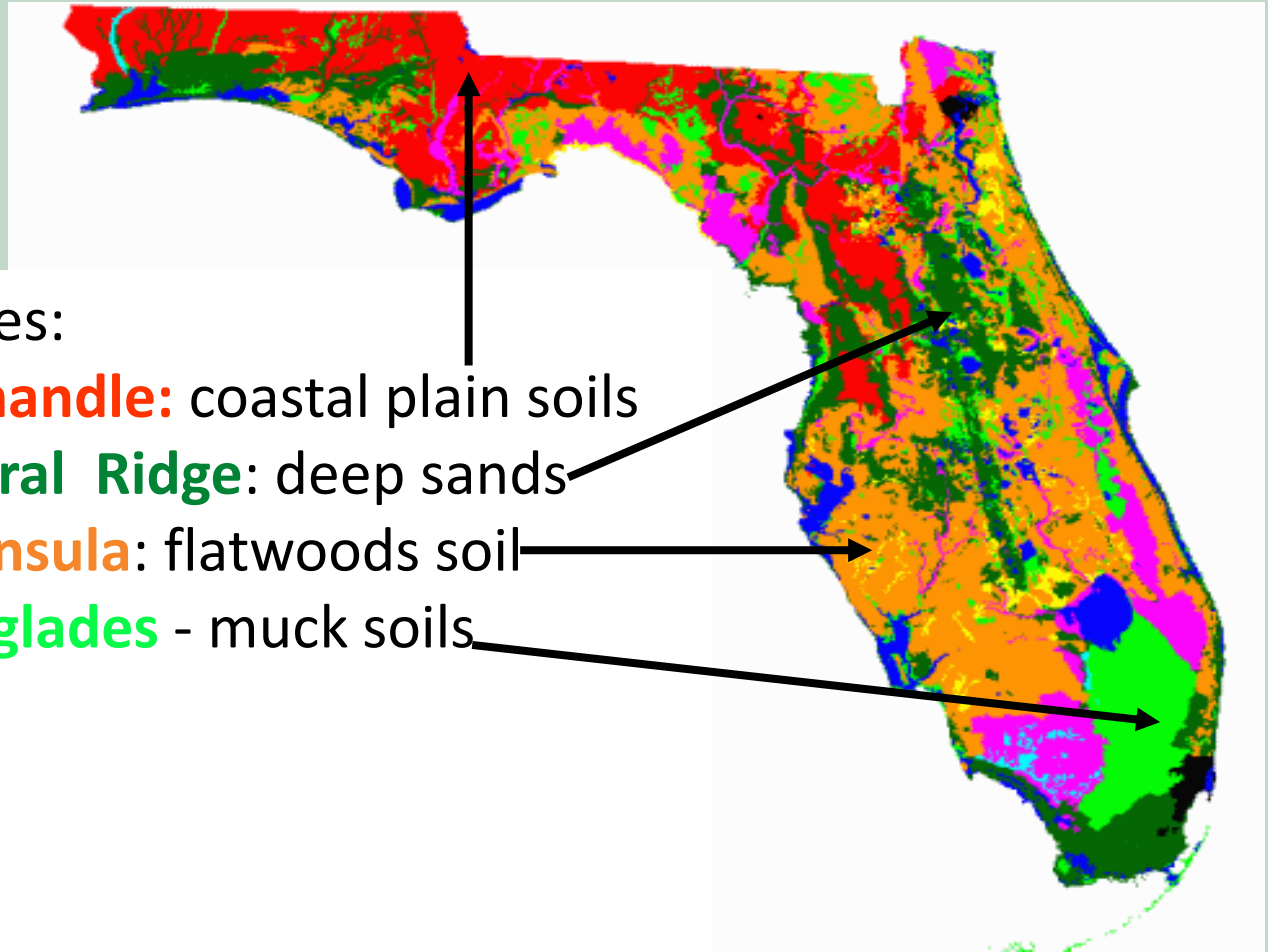


Florida Geology and Soils



- Situated on Floridian Plateau
- Influenced by marine forces (sea level)
- Limestone bedrock causes Karst features (sinkholes, caves, and springs).

Florida Geology and Soils



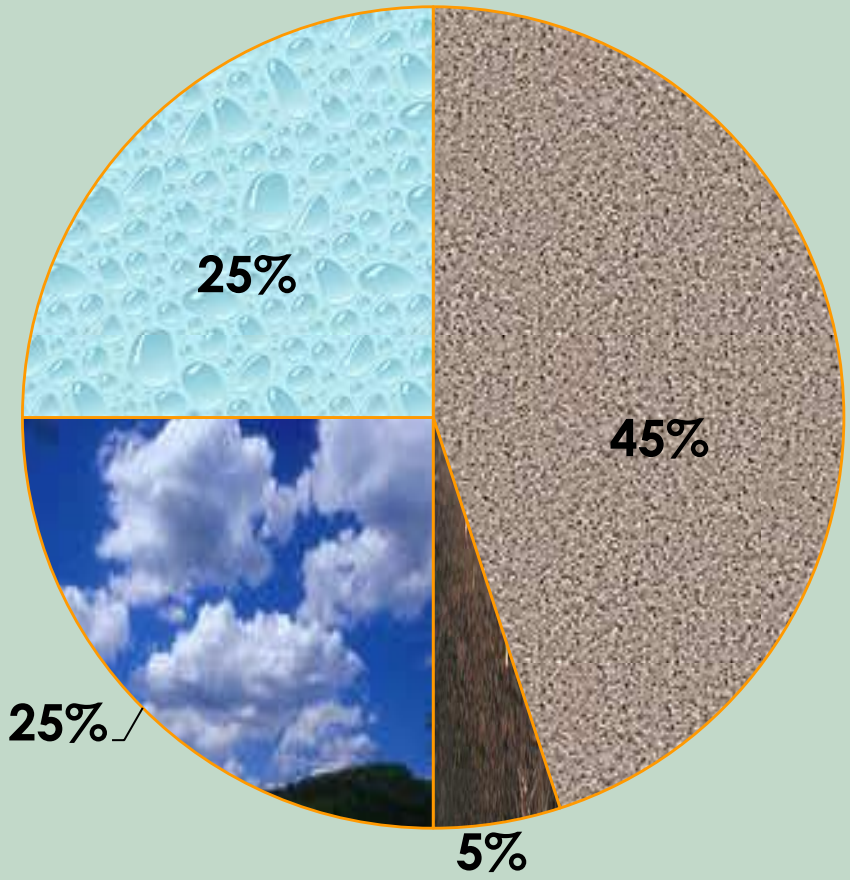
Examples:

- **Panhandle:** coastal plain soils
- **Central Ridge**: deep sands
- **Peninsula**: flatwoods soil
- **Everglades** - muck soils

Important Soil Terms

- Composition
- Particle size
- Texture
- Pore space / Drainage
- Compaction
- Organic matter
- Soil pH
- Salinity

Soil Composition



- Mineral
- Organic Matter
- Air
- Water

Figure Credit: Amy Shober, UF-IFAS

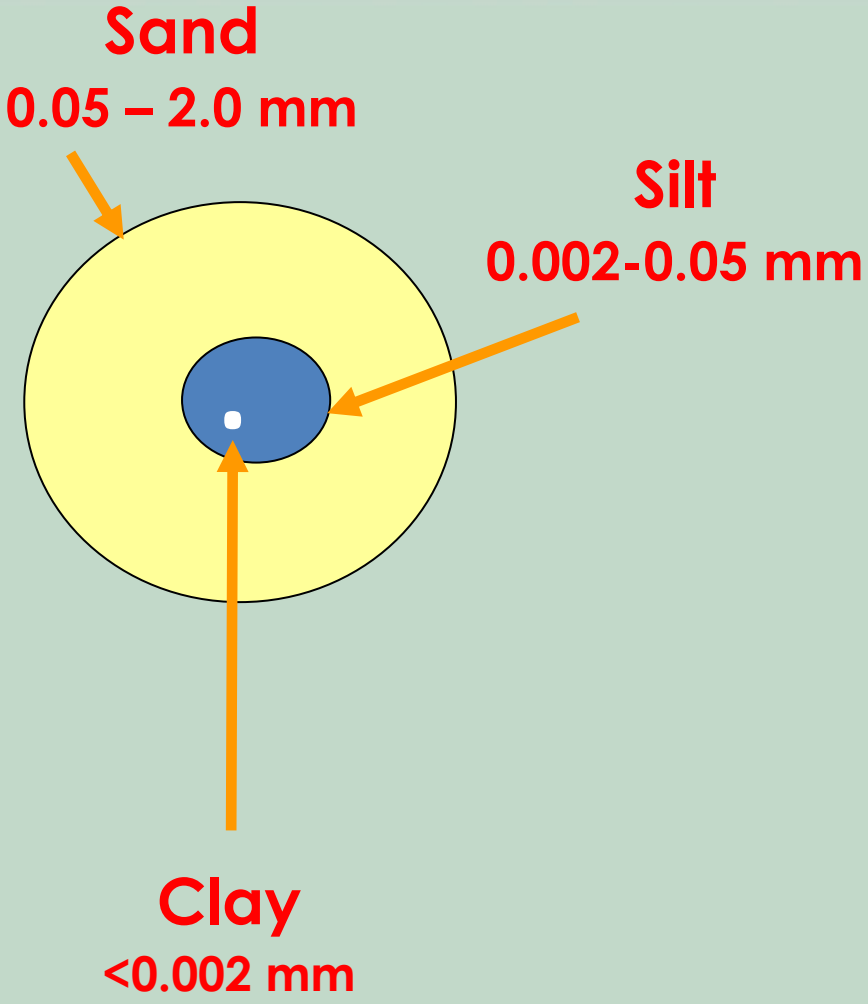
The Health of Your Soil

The big question. Is soil alive?

The 5th Element

Microorganisms

Particle Size

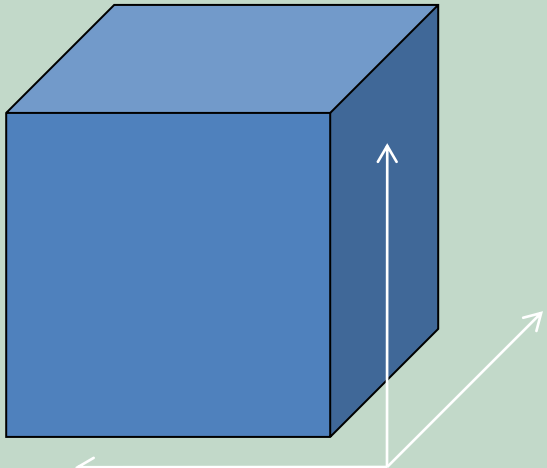


The terms sand, silt, and clay describe the size of *mineral* particles.

As particle size *decreases*, their influence on nutrient and water holding capacity *increases*.

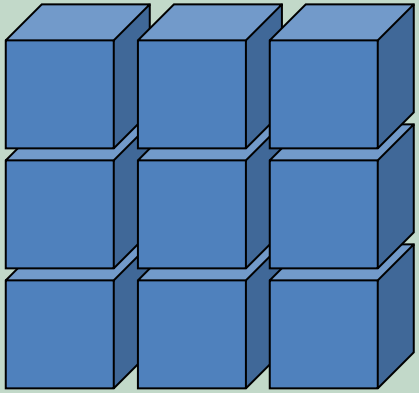
Particle Size

- Sand Particle



1 cube with 6 sides

- Clay Particles



27 cubes with 6 sides

Surface Area of a cube = l x w x 6

Smaller particles have more surface area to interact with nutrients and water molecules.

Soil Texture

- Texture is the proportions of sand, silt and clay

- Florida peninsular soils
  - Sand
  - Loamy sand
  - Sandy loam

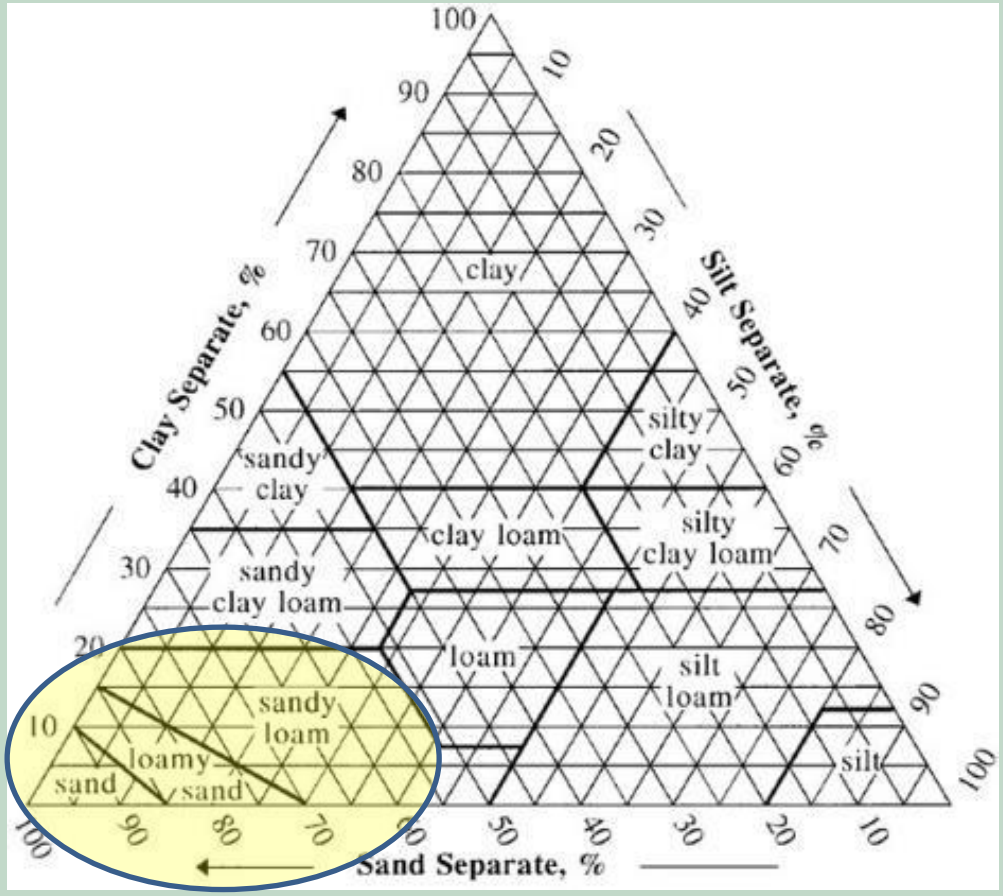


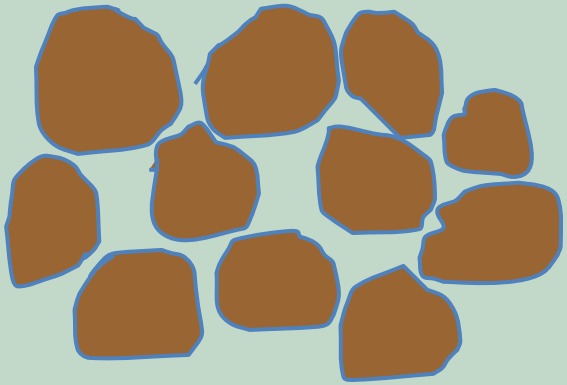
Figure credit: USDA-NRCS

Soil Structure

- Aggregates
  - Single grain
  - Granular
  - Platy
  - Blocky
- Improving soil structure
  - Growing cover crops
  - Adding OM
  - Mulching

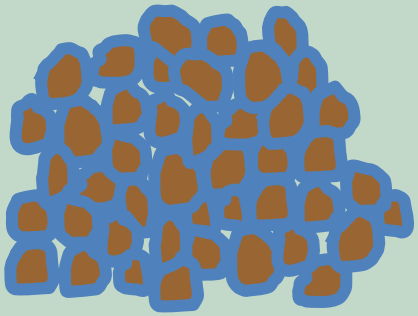
Soil Pores & Drainage

Macropores dominate in sandy soils



- Good drainage
- Low water holding capacity

Micropores dominate in clay soils



- Poor drainage
- High water holding capacity

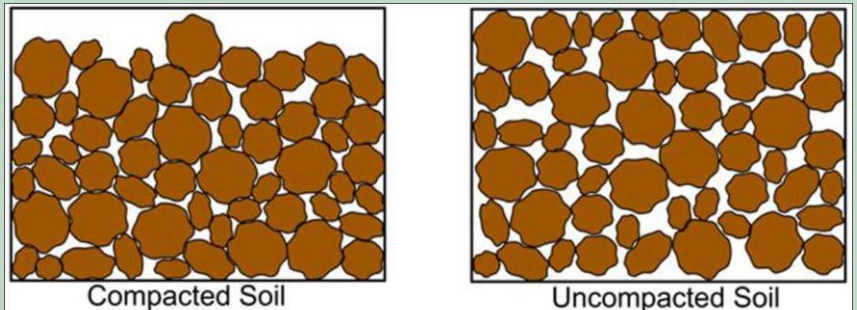
Soil Water

- Gravitational water: fast, temporary
- Capillary water: long availability and upward
- Matrix force water: sideways moving
- Hygroscopic water: unavailable
- Field capacity and available water
- Evapotranspiration
  - Evaporation
  - Transpiration

Urban (disturbed) Soils

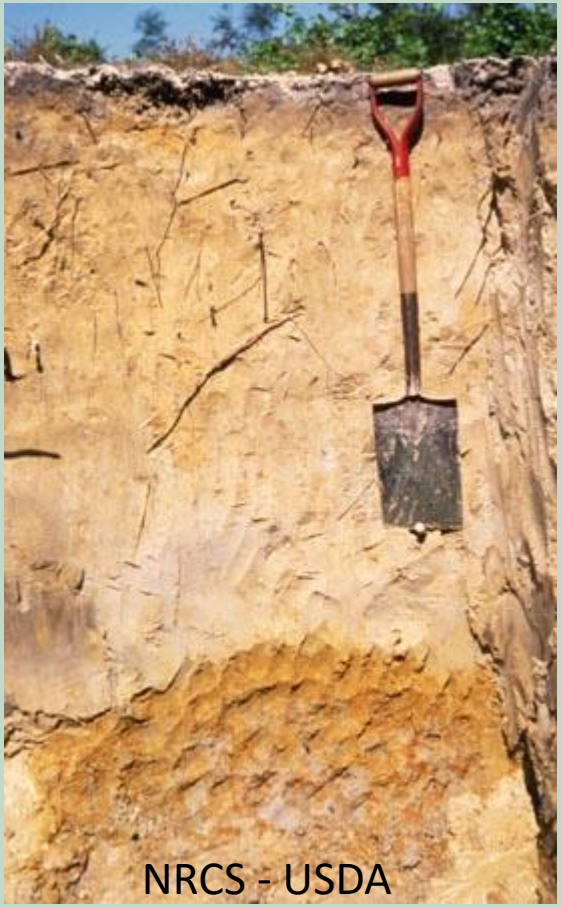
- Often compacted during construction
- Compaction reduces pore space and leads to:
  - Poor drainage
  - Poor root growth
  - Inconsistent plant growth throughout landscape
  - Erosion and run-off

Photo Credit: Amy Shober, UF-IFAS



Soil Horizons and Depth

Sandy soils



Organic soils

Depth:

Very Shallow 0 – 10”

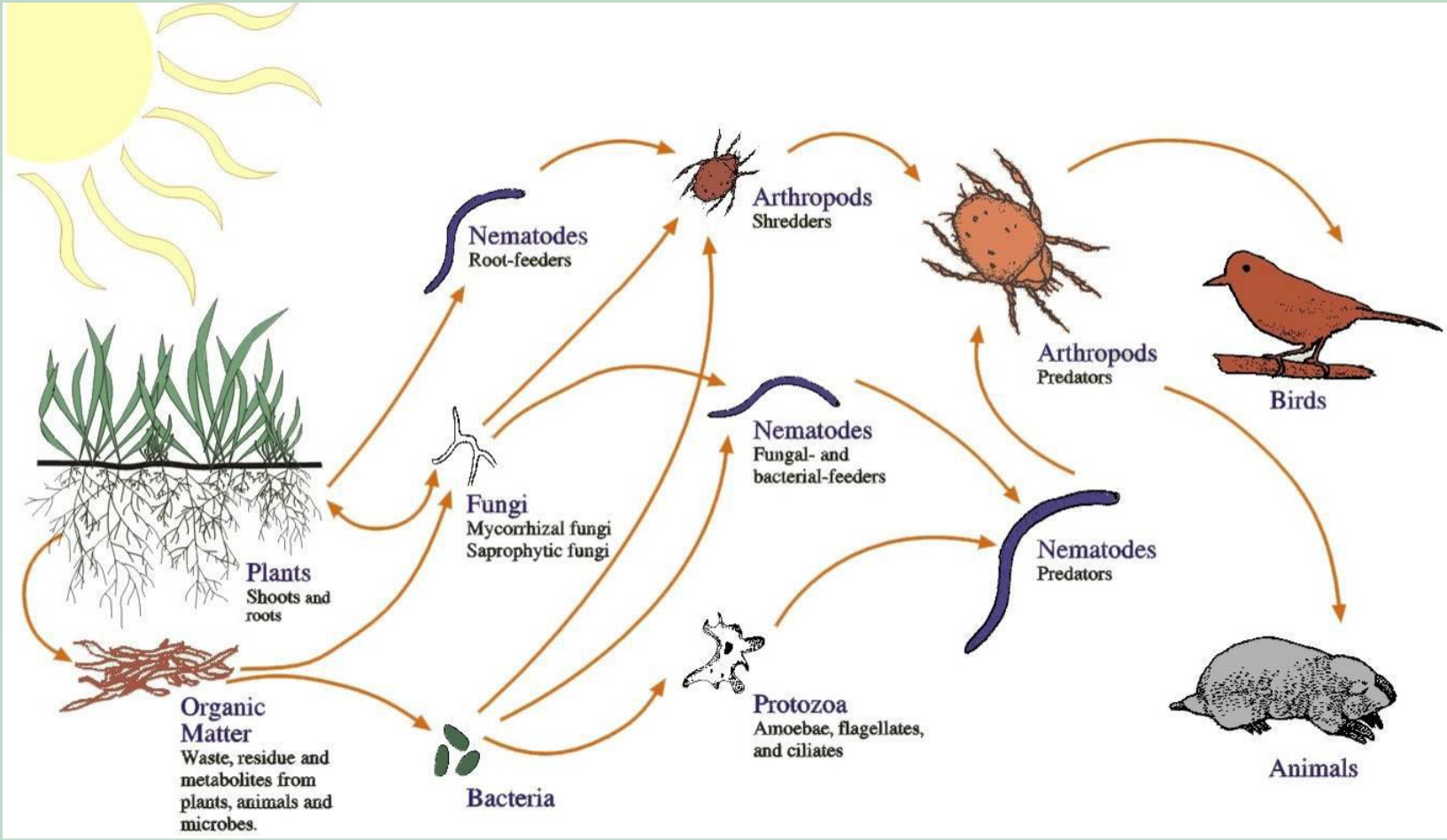
Shallow: 10 – 20”

Moderately deep: 20 – 39”

Deep: 39 – 59”

Very deep: 59” +

The Soil Food Web



Pet Care

What do your pets need for good health?

Shelter
Food
Water

Soil Microorganisms

What do your microorganisms need for good health?

Shelter
Food
Water

Soil Microorganisms

- Microscopic plants and animals
- Actinomycetes, algae, bacteria, fungi, nematodes, protozoa, viruses and yeast
- One pound of healthy soil contains 1 trillion microorganisms
- One tablespoon of healthy soil contains 1 billion microorganisms

Soil Microorganisms

One gram of healthy soil (weight of a paperclip)

- Bacteria = 100,000,000 to 1,000,000,000
- Actinomycetes = 10,000,000 to 100,000,000
- Fungi = 100,000 to 1,000,000
- Protozoa = 10,000 to 100,000
- Algae = 10,000 to 100,000
- Nematodes = 10 to 100

Soil Macroorganisms

- Earthworms
- Crustaceans: pillbugs
- Arthropods: beetles, ants, millipedes, centipedes, sowbugs, termites, spiders, mites and roaches

Organic Matter

- Plant and animal waste in various states of decomposition

  (e.g., compost, leaves, grass clippings, manure, mulch, etc.)

- Benefits to plants:

  - Can supply all the essential nutrients (in very small amounts)
  - Releases nutrients slowly

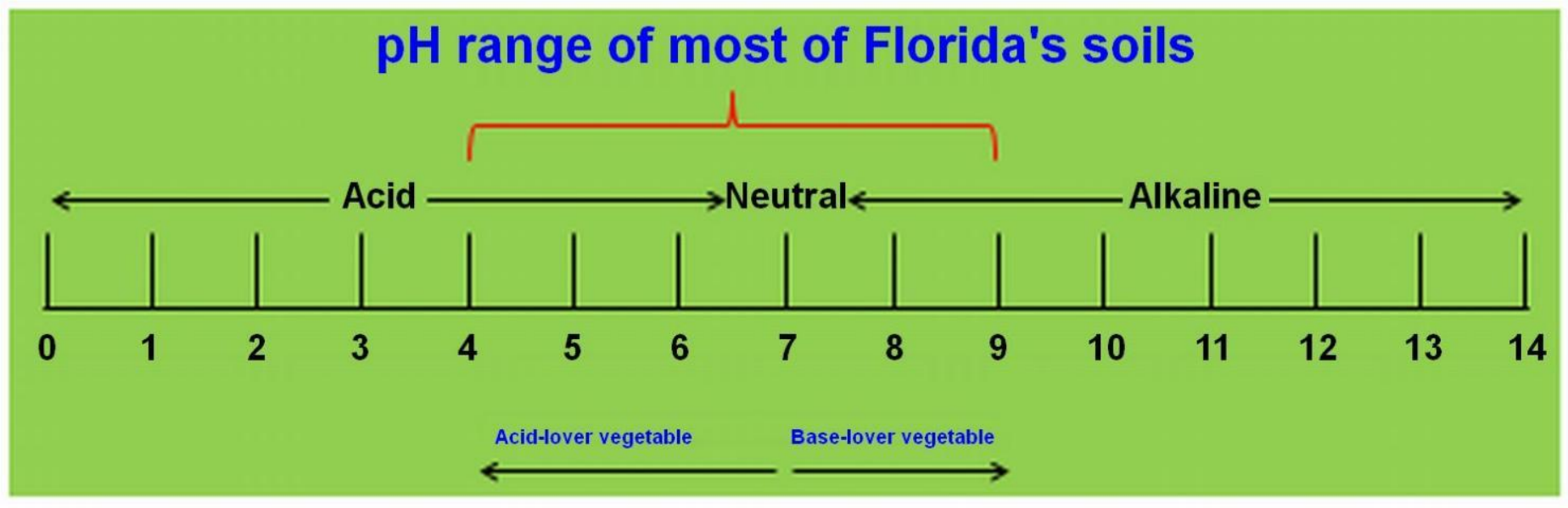
Organic Matter

Benefits to soil:

- Improves soil structure
- Supports microbes and “soil life”
- Improves water-holding capacity
- Improves nutrient-holding capacity
- Buffers soil from drastic changes
  Releases organic acids that dissolve minerals into usable nutrients
  Provides a small, steady supply of nutrients

Soil pH

A measure of acidity or alkalinity of the soil.



- Median soil pH of FL soils is 6.1 (slightly acidic)
- But pH varies widely depending on “parent material” or management of soil

Soil pH

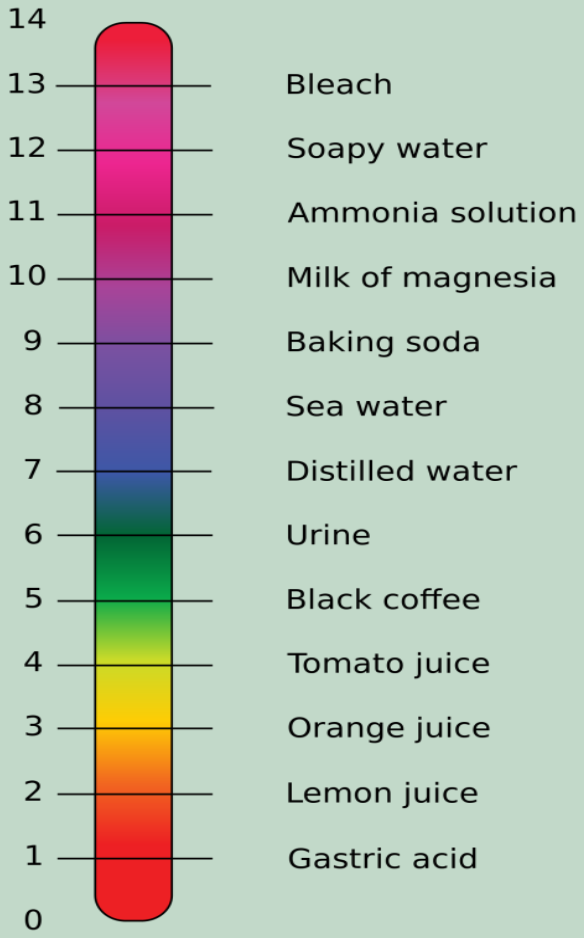
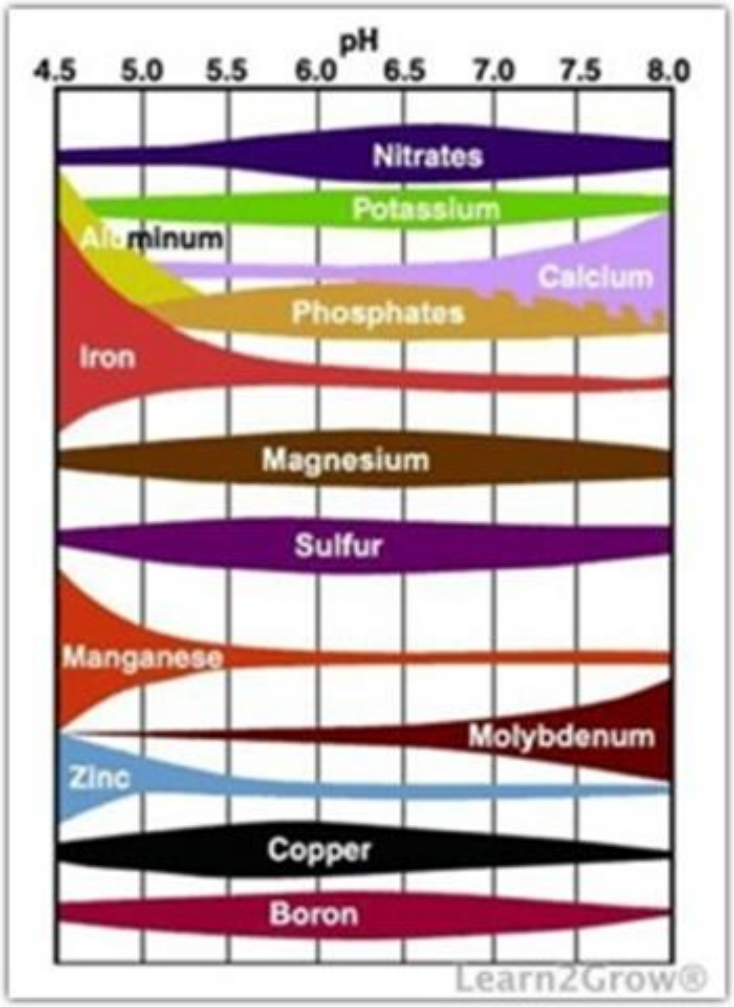


Table 2.2. Descriptive terms for ranges in soil pH and selected common compounds.

Soil descriptive term	pH	Common range compounds
	0	
	1	Battery acid
	2	Lime and lemon juice, vinegar, apple cider
Ultra acid	<3.5	
Extremely acid	3.5–4.4	Tomato juice
Very strongly acid	4.5–5.0	
Strongly acid	5.1–5.5	
	≤5.6	"Acid" rain
	5.6–5.7	"Pure" rain, distilled water
Moderately acid	5.6–6.0	
Slightly acid	6.1–6.5	Cow's milk, coffee
Neutral	6.6–7.3	
Slightly alkaline	7.4–7.8	
Moderately alkaline	7.9–8.4	Baking soda
Strongly alkaline	8.5–9.0	
Very strongly alkaline	>9.0	
	10–11	
	12	Ammonia
	13	Lye
	14	

pH and Plant Nutrients



- pH affects the solubility/availability of plant nutrients
- Optimum nutrient availability: pH 6.0 - 7.0
- pH also affects activity of soil microbes

Soil pH Tips

- Always test soil before trying to adjust pH.
- For home gardens and landscape - no adjustment is needed if pH is between 5.5 and 7.0.
- Most landscape plants grow in a wide pH range; except “acid-loving” plants.
- Grow plants with special pH needs in containers.
- If your plants are doing well don’t mess with pH!

Adjusting Soil pH

- Not a permanent solution: Right plant, right place is still better
- Container growing for lower pH plants

Raising soil pH

- Add lime (calcium carbonate or dolomite)
- Lime neutralizes acidity & supplies calcium

Adjusting Soil pH

Lowering Soil pH

- If naturally alkaline, little can be done to lower it
- Marginally-alkaline soils can be acidified with:
  - Elemental sulfur, iron sulfate, or aluminum sulfate
  - Acid-forming fertilizers
  - Organic matter (ex: pine bark, peat)

Adjusting Soil pH

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  - acid-forming fertilizers
  - organic matter (ex: pine bark, peat)

Soil Salinity

- High soil salts
  - Coastal flooding
  - Salty irrigation water
  - Excessive fertilization
- Salinity problems
  - Mg or K deficiency
  - Plant wilt
  - Leaf burn/Necrosis

Dealing with Salt-Affected Soils

- Leach salts with rain or irrigation.
- Test irrigation water for salts.
- Choose salt-tolerant plants (Right plant/Right place).

Salt Tolerant Plants for Florida - http://ufdc.ufl.edu/IR00001713/00001
Tackling Soil Salinity Problems in the Home Landscape – http://edis.ifas.ufl.edu/mg447

Soil Testing

- Tools
  - Bucket
  - Shovel or trowel
  - Paper bag or newspaper for drying
  - Soil test forms and sample bags are available for free at county Extension offices

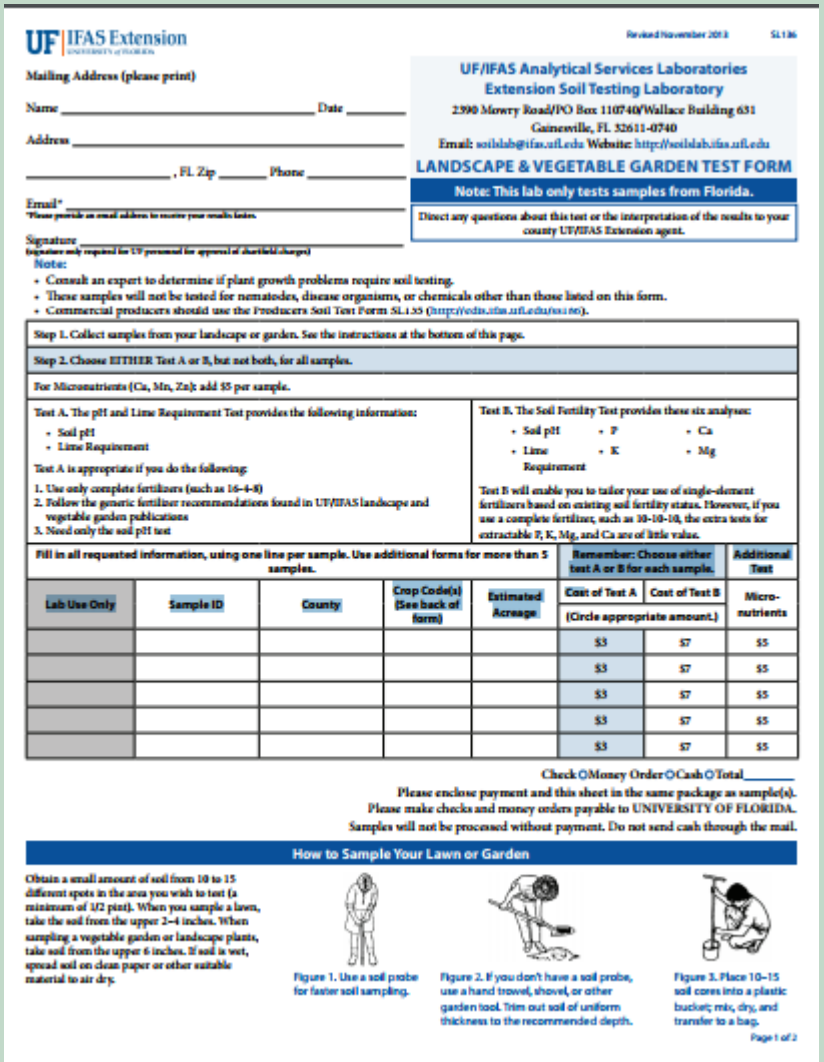
Soil Testing

1. Take the sample:
   - Choose a representative area.
   - Sample “good”& “bad” areas separately.
   - Take 10-15 cores from the top 6-8 inches of soil (2-4 inches for turfgrass).
   - Mix the cores.

Figure Credit: Amy Shober, UF-IFAS

Soil Probe

Soil Testing



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Revised November 2013 SL136

Mailing Address (please print)

Name _____ Date _____

Address _____

_____, FL Zip _____ Phone _____

Email* _____
*Please provide an email address to receive your results online.

Signature _____
(signature only required for UF personnel for approval of shorthold charges)

UF/IFAS Analytical Services Laboratories
Extension Soil Testing Laboratory
2390 Mowry Road/PO Box 110740/Wallace Building 631
Gainesville, FL 32611-0740
Email: soillab@ifas.ufl.edu Website: http://soillab.ifas.ufl.edu

LANDSCAPE & VEGETABLE GARDEN TEST FORM

Note: This lab only tests samples from Florida.

Direct any questions about this test or the interpretation of the results to your county UF/IFAS Extension agent.

Note:
- Consult an expert to determine if plant growth problems require soil testing.
- These samples will not be tested for nematodes, disease organisms, or chemicals other than those listed on this form.
- Commercial producers should use the Producers Soil Test Form SL135 (http://edis.ifas.ufl.edu/ss106).

Step 1. Collect samples from your landscape or garden. See the instructions at the bottom of this page.

Step 2. Choose EITHER Test A or B, but not both, for all samples.

For Micronutrients (Ca, Mn, Zn): add $5 per sample.

Test A. The pH and Lime Requirement Test provides the following information:
- Soil pH
- Lime Requirement

Test A is appropriate if you do the following:
1. Use only complete fertilizers (such as 16-4-8)
2. Follow the generic fertilizer recommendations found in UF/IFAS landscape and vegetable garden publications
3. Need only the soil pH test

Test B. The Soil Fertility Test provides these six analyses:
- Soil pH
- Lime Requirement
- P
- K
- Ca
- Mg

Test B will enable you to tailor your use of single-element fertilizers based on existing soil fertility status. However, if you use a complete fertilizer, such as 10-10-10, the extra tests for extractable P, K, Mg, and Ca are of little value.

Fill in all requested information, using one line per sample. Use additional forms for more than 5 samples.

Remember: Choose either test A or B for each sample.

Additional Test

Lab Use Only	Sample ID	County	Crop Code(s) (See back of form)	Estimated Acreage	Cost of Test A (Circle appropriate amount.)	Cost of Test B (Circle appropriate amount.)	Micro-nutrients
					$3	$7	$5
					$3	$7	$5
					$3	$7	$5
					$3	$7	$5
					$3	$7	$5

Check ○Money Order ○Cash ○Total_____

Please enclose payment and this sheet in the same package as sample(s).
Please make checks and money orders payable to UNIVERSITY OF FLORIDA.
Samples will not be processed without payment. Do not send cash through the mail.

How to Sample Your Lawn or Garden

Obtain a small amount of soil from 10 to 15 different spots in the area you wish to test (a minimum of 1/2 pint). When you sample a lawn, take the soil from the upper 2–4 inches. When sampling a vegetable garden or landscape plants, take soil from the upper 6 inches. If soil is wet, spread soil on clean paper or other suitable material to air dry.

Figure 1. Use a soil probe for faster soil sampling.

Figure 2. If you don't have a soil probe, use a hand trowel, shovel, or other garden tool. Trim out soil of uniform thickness to the recommended depth.

Figure 3. Place 10–15 soil cores into a plastic bucket; mix, dry, and transfer to a bag.

Page 1 of 2

2. Air-dry 2 cups of soil.
3. Complete soil test form.
4. Send labeled sample, form, and payment to lab for testing.
5. Results come with recommendations.

Soil Testing

- The UF Extension Soil Testing Lab tests the soil for pH, P (phosphorous), K (potassium), Ca (calcium) and Mg (Magnesium) – *NOT N (Nitrogen).* $7 per sample; $3 for just pH.
- Provides recommendations for pH adjustments and/or additional nutrients.

Information and forms:
http://soilslab.ifas.ufl.edu/ESTL%20Tests.asp

Activity #1
Soil Sampling
(Class or Homework Activity)

Collect a soil sample from a lawn, landscape, or garden following the instructions and procedure outlined in the Student Handbook.

Part II -
Plant Nutrition & Fertilizers

Learning Objectives:

- Know the 17 essential plant nutrients.
- Recognize common nutrient deficiency symptoms.
- Define common fertilizer terms:
  - Grade (aka Analysis)
  - Ratio
  - Complete
  - Inorganic (synthetic) vs Natural Organic Fertilizers
  - Water soluble vs controlled-release

16 – 17* Essential Nutrients

Supplied by Air and Water:

Carbon (C), Hydrogen (H), and Oxygen (O_2)

Usually Supplied by the Soil:

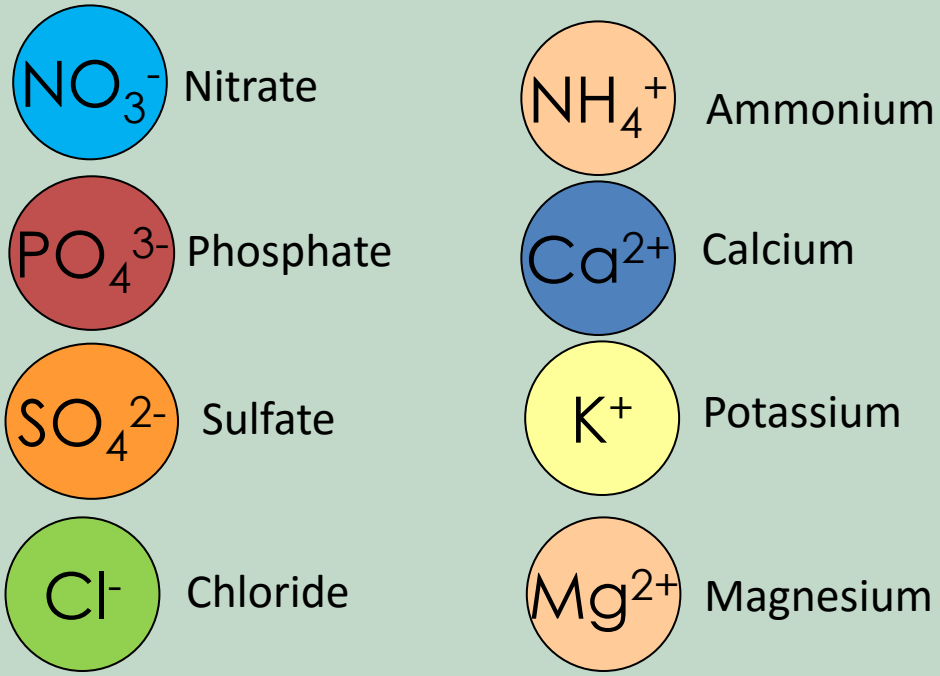
Macronutrients

- Nitrogen (N)
- Phosphorus (P)
- Potassium (K)
- Calcium (Ca)
- Magnesium (Mg)
- Sulfur (S)

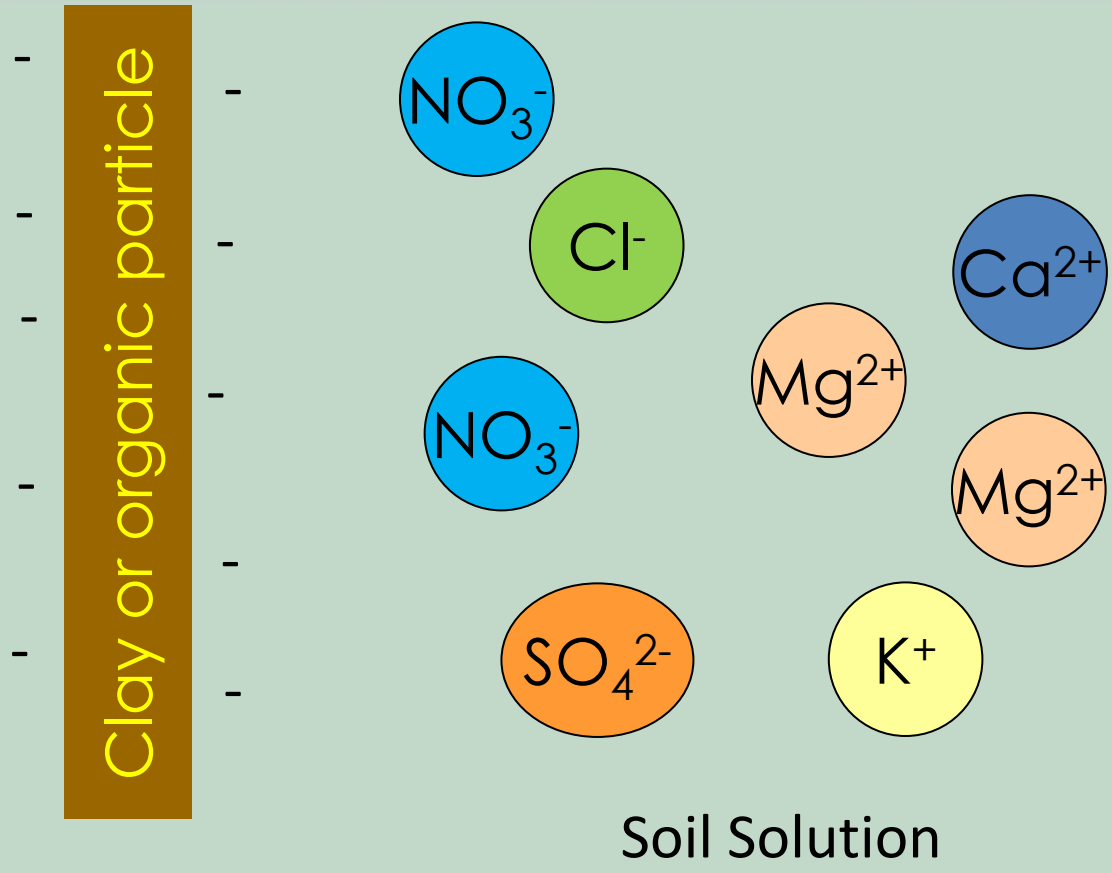
Micronutrients

- Boron (B)
- Chlorine (Cl)
- Copper (Cu)
- Iron (Fe)
- Molybdenum (Mo)
- Manganese (Mn)
- Nickel (Ni) *
- Zinc (Zn)

Plant nutrients – Cations and Anions



Soil Nutrient Holding Capacity



Phosphate

- The predominant form of phosphorus taken up by plants.
- Does not readily leach from FL soil.
- Moves with *soil particles* – as when erosion occurs.
- Test soil every few years to determine if phosphorus is needed.

Why Fertilize?

- Achieve desirable plant response
  - Growth
  - More fruits / flowers
- Prevent/correct nutrient deficiencies

Credit: Brent Harbaugh, UF/IFAS

Nutrient Response to Plant Growth

Table 1. The 13 essential mineral nutrients required by all plants for normal growth and development.

Nutrient	Chemical symbol	Relative abundance (%)	Function in plant
Nitrogen	N	100	Proteins, amino acids
Potassium	K	25	Catalyst, ion transport
Calcium	Ca	12.5	Cell wall component
Magnesium	Mg	8	Part of chlorophyll
Phosphorus	P	6	Nucleic acids, ATP
Sulfur	S	3	Amino acids
Chlorine	Cl	0.3	Photosynthesis reactions
Iron	Fe	0.2	Chlorophyll synthesis
Boron	B	0.2	Cell wall component
Manganese	Mn	0.1	Activates enzymes
Copper	Cu	0.01	Component of enzymes
Zinc	Zn	0.03	Activates enzymes
Molybdenum	Mo	0.0001	Involved in N fixation

Nutrient Response to Plant Growth

UF IFAS Extension UNIVERSITY of FLORIDA

HS1181

Mineral Nutrition Contributes to Plant Disease and Pest Resistance[1]

Arnold W. Schumann, Tripti Vashisth, and Timothy M. Spann[2]

https://edis.ifas.ufl.edu/pdffiles/HS/HS118100.pdf

UF IFAS Extension UNIVERSITY of FLORIDA

SS-AGR-418

Micronutrients Considerations for Warm-Season Forage Grass Systems in Florida[1]

Jane C. Griffin, Joao Vendramini, Diane Rowland, and Maria L. Silveira[2]

https://edis.ifas.ufl.edu/pdffiles/AG/AG41900.pdf

Nutrient Response to Plant Growth

UF IFAS Extension
UNIVERSITY of FLORIDA

SL 200

Plant Nutrients for Citrus Trees[1]

Mongi Zekri and Thomas A. Obreza[2]

https://edis.ifas.ufl.edu/pdffiles/SS/SS41900.pdf

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SL-3

The Florida Fertilizer Label[1]

T. W. Shaddox[2]

https://edis.ifas.ufl.edu/pdffiles/SS/SS17000.pdf

Diagnosing a Nutrient Deficiency

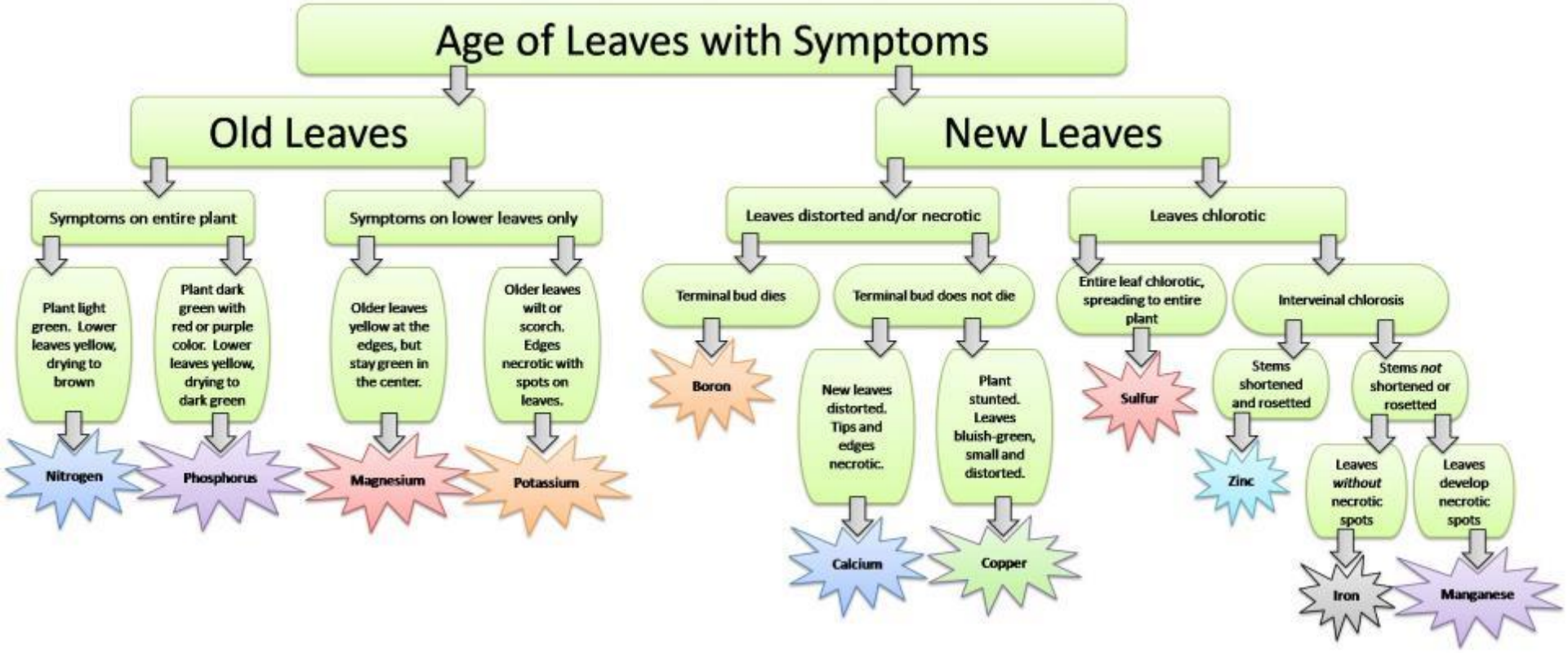


Figure Credit: Geoff Denny, UF-IFAS

See also: NutDef – Online nutrient key
http://hort.ufl.edu/database/nutdef/index_decision.shtml

Common Nutrient Deficiency Symptoms in Florida

Nitrogen

Potassium

Magnesium

Manganese

Iron

Photo Credits: UF-IFAS NUTDEF website; Brent Harbaugh, UF-IFAS (P only)

Lawn and Landscape Fertilizers

Fertilizer Terms

- **Blend**: Several nutrient sources mixed together to create a fertilizer for a specific purpose.
- **Grade (Analysis):** the % by weight of N, P_2O_5, & K_2O
  Example: 16-4-8 = 16% N, 4% P_2O_5, 8% K_2O
- **Ratio:** the relationship among the grade
  Example: 16-4-8 fertilizer has a ratio of 4-1-2
- **Complete fertilizer:** contains N, P & K

Fertilizer Terms

- **Incomplete fertilizer:** missing one or more of N, P & K
- **Special-Purpose fertilizer:** packed for certain uses or crops
- **Prill:** coated granule of fertilizer for controlled release

Test Yourself

- What is the grade of this fertilizer?

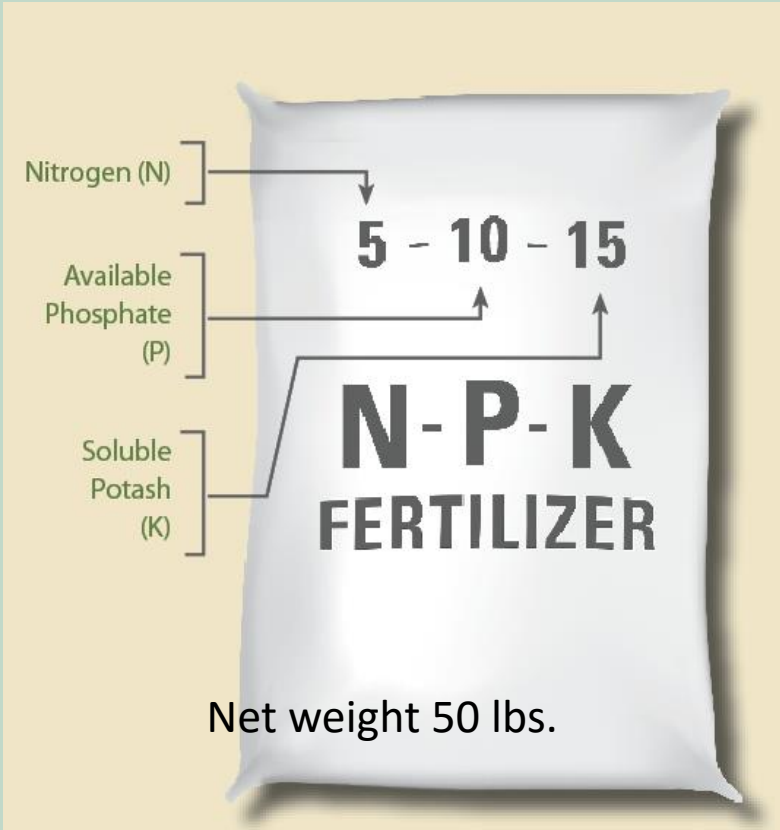
  5-10-15

- How many pounds of nutrients does it contain?

  15 (.30 x 50 lbs.) + micro %

- What is the fertilizer ratio?

  1:2:3



Nitrogen Forms

- Nitrate
- Ammoniacal
- Ammonia
- Urea

Brand Name
X-X-X (Grade)
Guaranteed Analysis

Total N..... ____%
_____% Nitrate N
_____% Ammoniacal N
_____% Other/Water soluble N
_____% Urea N
_____% Water Insoluble N
Available Phosphate (P_2O_5).....____%
Soluble Potash (K_2O).....____%
Chlorine, (Cl) Not More Than...____%
Secondary Nutrients (if any by %)
Derived from:
Manufactured by: Name, City, State, Zip
Net Weight - _____lb

See: *The Florida Fertilizer Label*/EDIS SL-3

The Florida Fertilizer Label

Guaranteed analysis

- Total N (%) broken down into:
  - Nitrate N
  - Ammoniacal N
  - Other/Water Soluble N
  - Urea N
  - Water insoluble N
- Available Phosphate (P_2O_5)
- Soluble Potash (K_2O)
- Chlorine (Cl) not more than…
- Statement of secondary plant nutrients (if any)
- "Derived from" statement
- Manufacturer/registrant info
- Net Weight

Brand Name
X-X-X (Grade)
Guaranteed Analysis

Total N…… ____%
_____% Nitrate N
_____% Ammoniacal N
_____% Other/Water soluble N
_____% Urea N
_____% Water Insoluble N
Available Phosphate (P_2O_5)……____%
Soluble Potash (K_2O)……____%
Chlorine, (Cl) Not More Than...____%
Secondary Nutrients (if any by %)
Derived from:
Manufactured by: Name, City, State, Zip
Net Weight - _____lb

See: *The Florida Fertilizer Label*/EDIS SL-3

Fertilizer Terms

- Inorganic or Synthetic fertilizers: Mined or synthesized from non-living (inorganic) materials
  Examples:
  - ammonium nitrate
  - ammonium phosphate
  - potassium chloride
- Natural Organic fertilizers: Derived from the remains or by-products of living organisms
  Examples:
  - Fish Meal
  - Bone Meal
  - Manure
  - Compost

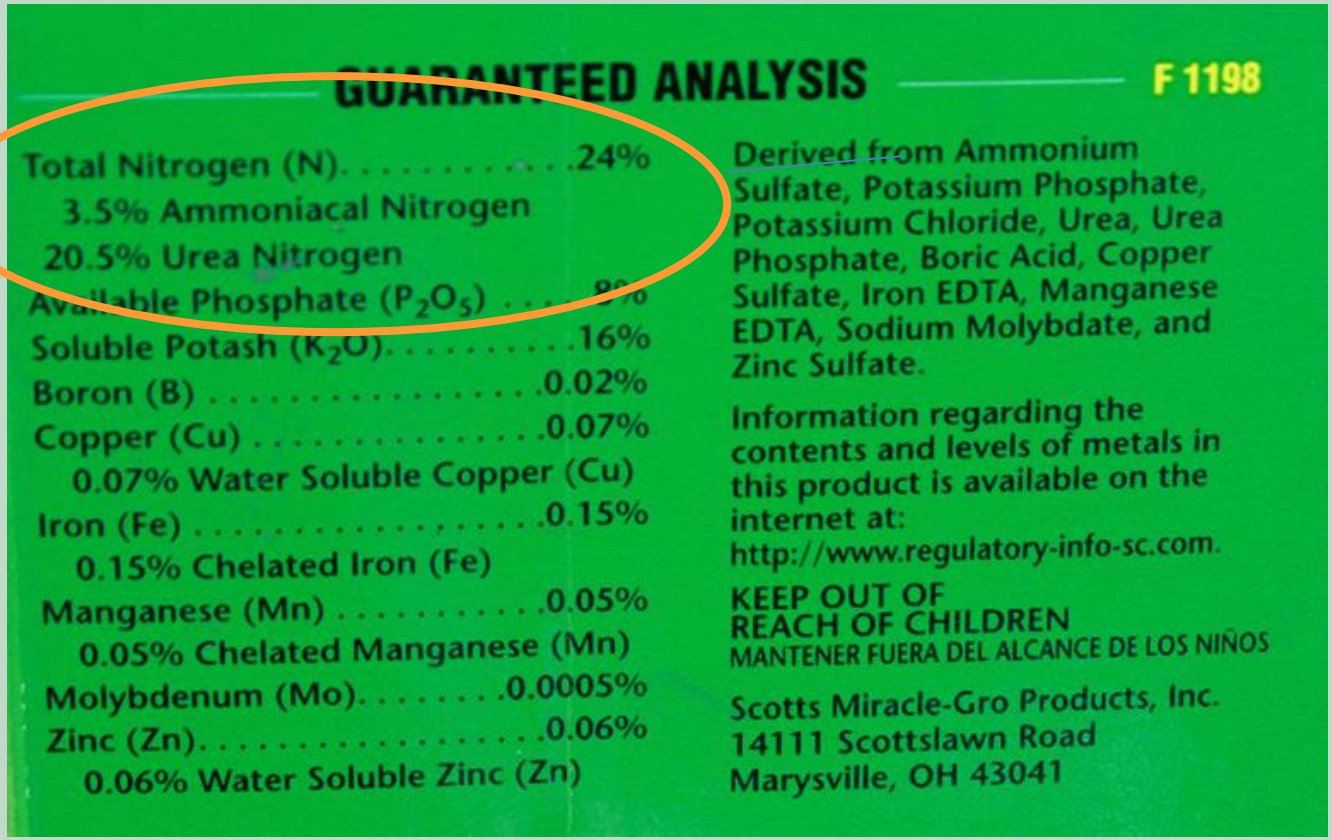
Fertilizer Types

- Water soluble fertilizer (Quick-release): Nutrients readily dissolve in water; immediately available for uptake by plant roots. (ammonium phosphate, KCl, magnesium sulfate, urea, Miracle-Gro, etc.)

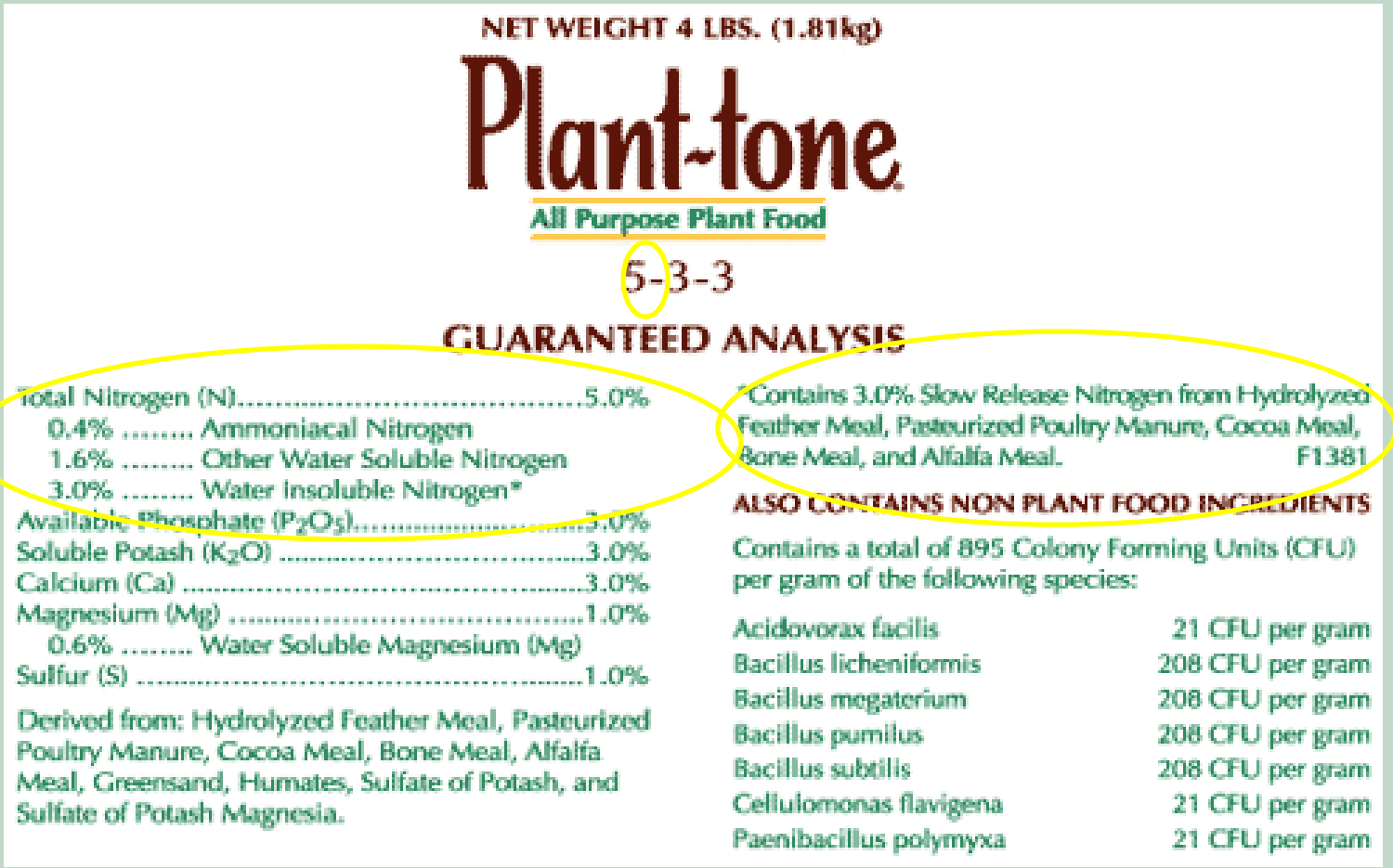
- Slow-release fertilizer: Synthetic or organic materials that gradually become soluble. Derived from:
  - natural, organic sources (manure, compost, fish emulsion, blood meal, etc.)
  - synthetic sources (IBDU, UF, etc.)

- Controlled-release fertilizer: Coated or encapsulated materials modified to release nutrients at a specific rate and duration. (Osmocote, Nutricote, etc.)

Quick-release N Fertilizer



Slow-release Organic-N Fertilizer



NET WEIGHT 4 LBS. (1.81kg)

Plant-tone

All Purpose Plant Food

5-3-3

GUARANTEED ANALYSIS

Total Nitrogen (N)	5.0%
0.4% ..... Ammoniacal Nitrogen	
1.6% ..... Other Water Soluble Nitrogen	
3.0% ..... Water Insoluble Nitrogen*	
Available Phosphate (P_2O_5)	3.0%
Soluble Potash (K_2O)	3.0%
Calcium (Ca)	3.0%
Magnesium (Mg)	1.0%
0.6% ..... Water Soluble Magnesium (Mg)	
Sulfur (S)	1.0%

Derived from: Hydrolyzed Feather Meal, Pasteurized Poultry Manure, Cocoa Meal, Bone Meal, Alfalfa Meal, Greensand, Humates, Sulfate of Potash, and Sulfate of Potash Magnesia.

*Contains 3.0% Slow Release Nitrogen from Hydrolyzed Feather Meal, Pasteurized Poultry Manure, Cocoa Meal, Bone Meal, and Alfalfa Meal. F1381

ALSO CONTAINS NON PLANT FOOD INGREDIENTS

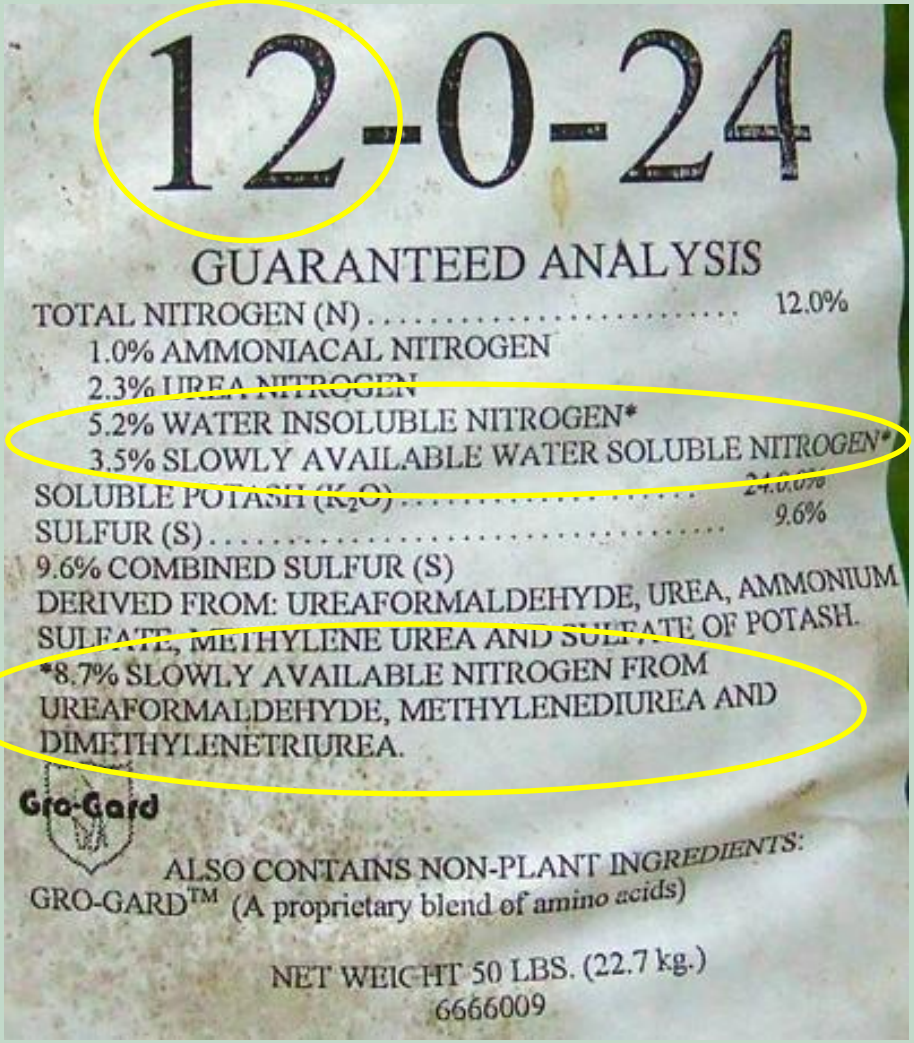
Contains a total of 895 Colony Forming Units (CFU) per gram of the following species:

Acidovorax facilis	21 CFU per gram
Bacillus licheniformis	208 CFU per gram
Bacillus megaterium	208 CFU per gram
Bacillus pumilus	208 CFU per gram
Bacillus subtilis	208 CFU per gram
Cellulomonas flavigena	21 CFU per gram
Paenibacillus polymyxa	21 CFU per gram

Slow-release Synthetic-N Fertilizer

Examples:

- Urea-formaldehyde
- IBDU



Synthetic/Controlled-release Fertilizer

Examples:

- Sulfur-coated urea
- Polymer-coated urea

Osmocote® Smart-Release® Plant Food Plus Multi-Purpose Plant Food

15-9-12 **GUARANTEED ANALYSIS** F1143

Total Nitrogen (N)†	15%
8.0% Ammoniacal Nitrogen	
7.0% Nitrate Nitrogen	
Available Phosphate (P_2O_5)†	9%
Soluble Potash (K_2O)†	12%
Calcium (Ca)†	1.9%
Magnesium (Mg) (Total)†	1.4%
0.7% Water Soluble Magnesium (Mg)	
Sulfur (S) (Total)†	4.0%
4.0% Combined Sulfur (S)	
Boron (B)†	0.02%
Copper (Cu) (Total)	0.05%
0.05% Water Soluble Copper (Cu)	
Iron (Fe) (Total)†	0.45%
0.42% Water Soluble Iron (Fe)	
0.03% Chelated Iron (Fe)	
Manganese (Mn) (Total)†	0.06%
0.06% Water Soluble Manganese (Mn)	
Molybdenum (Mo)†	0.02%
Zinc (Zn) (Total)	0.05%
0.019% Water Soluble Zinc (Zn)†	

†The Nitrogen, Phosphate, Potash, Calcium, Magnesium, Sulfur, Boron, Iron, Manganese, Molybdenum, and Zinc sources have been coated to provide 12.7% coated slow-release Nitrogen (N), 7.6% coated slow-release Available Phosphate (P_2O_5), 10.2% coated slow-release Soluble Potash (K_2O), 1.6% coated slow-release Calcium (Ca), 0.6% coated slow-release Magnesium (Mg), 3.4% coated slow-release Sulfur (S), 0.017% coated slow-release Boron (B), 0.38% coated slow-release Iron (Fe), 0.051% coated slow-release Manganese (Mn), 0.017% coated slow-release Molybdenum (Mo), 0.019% coated slow-release Zinc (Zn).

Scotts-Sierra Horticultural Products Company
14111 Scottslawn Road
Marysville, OH 43041

Information regarding the contents and levels of metals in this product is available on the Internet at www.regulatory-info-sc.com

Derived from: Polymer-Coated: Ammonium Nitrate, Ammonium Phosphate, Ammonium Sulfate, Calcium Phosphate, Potassium Sulfate, Potassium Nitrate, Potassium Chloride, Magnesium Oxide, Magnesium Sulfate, Calcium Carbonate, Ferrous Sulfate, Iron EDTA, Manganese Sulfate, Zinc Sulfate, Boric Acid, Sodium Molybdate; Copper Sulfate and Zinc Oxide.

Synthetic/Controlled-release Fertilizers

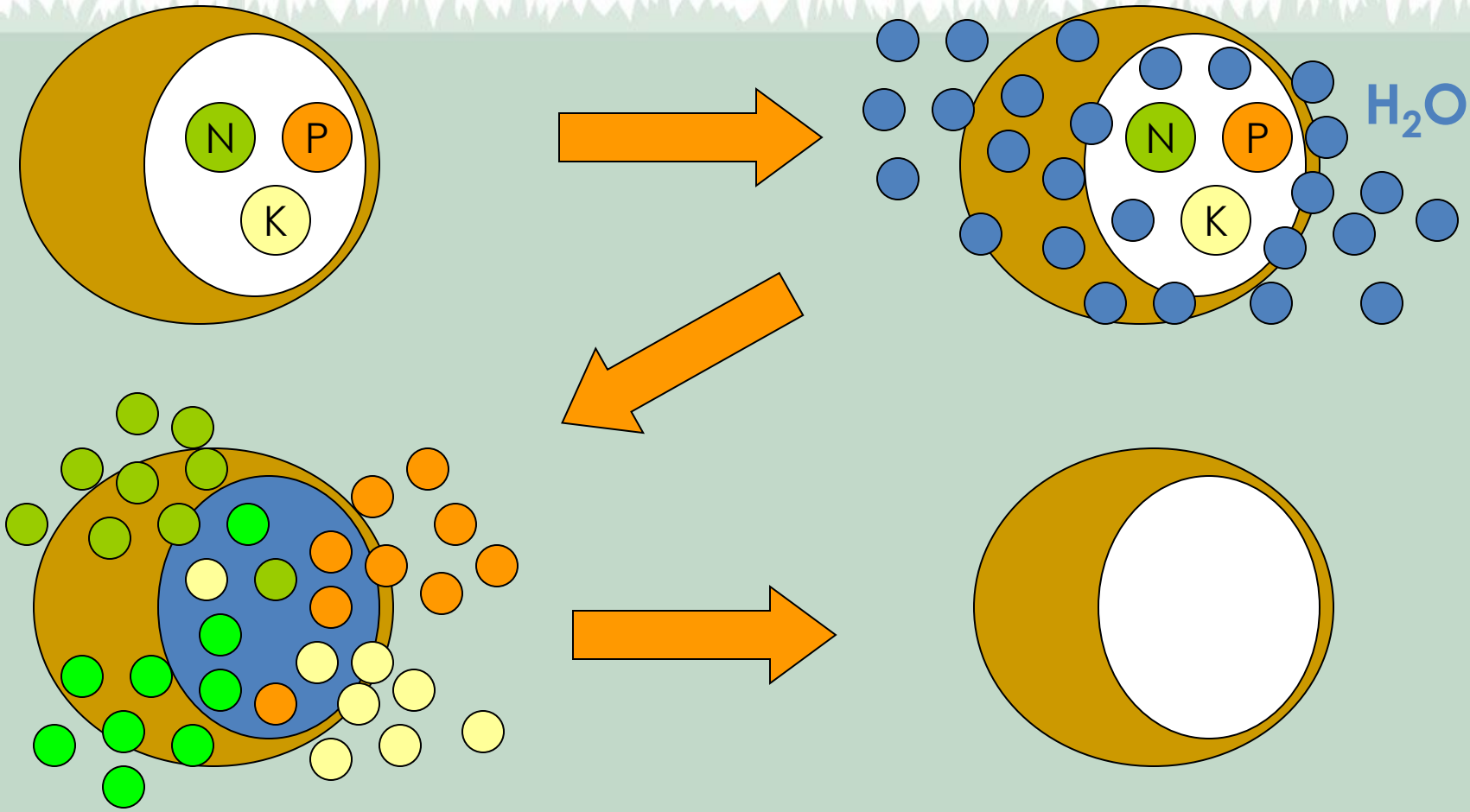


Figure Credit: Amy Shober

Organic Fertilizer Analyses

Table 2.5. Common organic sources of nutrients and their estimated nutrient content.

Source	% N	% P_2O_5	% K_2O	Remarks
Blood	10	1.5	0	A rapidly available source of nutrients
Fish scrap	9	7	0	Do not confuse with fish emulsives, which are generally quite low in nutrient content.
Guano, bat	6	9	3	Partially decomposed bat manure from caves
Guano, bird	13	11	3	Partially decomposed bird manure from islands
Kelp or seaweed	1	0.5	9	
Meal				
Bone, raw	4	22	0	Main value is nitrogen; phosphorus is slowly available on acid soils
Bone, steamed	2	27	0	As a result of steaming under pressure, some nitrogen is lost, but more phosphorus is plant available.
Cotton seed	6.0	2.5	2.2	Generally very acid; useful in alkaline soils
Cocoa shell	2.5	1	3	Use as mulch.
Hoof and horn	14	0	0	The steam-treated and ground material is a rather quickly available source of nitrogen.

Organic Fertilizer Analyses

Manure				Although manures are generally low in nutrients, when used in relatively large amounts to improve soil structure, they may cause damage because of too much salt. **These values are based on first-year mineralization rates. If applied yearly, after 3 years divide N by 0.5 and P_2O_5 by 0.8. The K_2O will remain the same.**
Dairy	0.6	0.3	0.6	
Cattle	0.6	0.4	0.7	
Chicken	1.4	2.8	2.2	
Horse	0.6	0.3	0.7	
Sheep	0.9	0.5	0.9	
Swine	0.6	0.4	0.6	
Mushroom compost, spent	1.0	1.0	2.3	
Oyster shell	0.2	0.3	0	Because of their alkalinity, oyster shells are best suited for raising pH rather than as a source of nutrients.
Peat (reed or sedge)	2	0.3	0.3	Best used as a soil conditioner rather than as a source of nutrients; breaks down too rapidly
Rice hulls, ground	0.5	.02	0.5	Degrade slowly
Sewage sludge, Class A	6.0	3.0	0.0	Examples of Class A sludges are Milorganite (Milwaukee, WI), Hu-Acinite (Houston), Chicagrow (Chicago, IL), Nitroganic (Pasadena, CA) and Dillo Dirt (Austin).
Wood ashes	0	2	6	Quite alkaline; do not use on high-pH soils

Lawn Fertilizer Calculation

Example 1:

UF | IFAS Extension UNIVERSITY of FLORIDA

ENH979

Homeowner Best Management Practices for the Home Lawn[1]

Laurie E. Trenholm[2]

Table 2. UF/IFAS recommendations for annual nitrogen application rates in pounds of nitrogen per 1,000 square feet of lawn.

	Annual Nitrogen Application Rates			
Region of State	**Bahiagrass**	**Centipedegrass**	**St. Augustinegrass**	**Zoysiagrass**
North	1–3	0.4–2	2–4	2–3
Central	1–3	0.4–3	2–5	2–4
South	1–4	0.4–3	4–6	2.5–4.5

Lawn Fertilizer Calculation

Example 1: You want to fertilize your centipedegrass turf in late spring. How many pounds of 15-2-15 fertilizer do you need for 1 pound of nitrogen per 1000 ft^2?

The lawn measures 35’ by 45’ in the front yard and 50’ by 75’ in the backyard.

$$\text{Fertilizer} = \frac{\text{N application rate}}{\text{\% N as a decimal}} \times \frac{\text{Lawn size}}{1{,}000}$$

Lawn Fertilizer Calculation

Calculate area of lawn

35 x 45 = 1,575

50 x 75 = 3,750

= 5,325

Fertilizer = _____ x _____

$$\text{Fertilizer} = \frac{1}{0.15} \times \frac{5{,}325}{1{,}000}$$

= 6.667 x 5.325

= 35.5 pounds of 15-2-15

Lawn Fertilizer Calculation

Calculate fertilizer for front yard.

35 x 45 = 1,575

$$\text{Fertilizer} = \frac{1}{0.15} \times \frac{1{,}575}{1{,}000}$$

$$= 6.667 \times 1.575$$

= 10.5 pounds of 15-2-15

Lawn Fertilizer Calculation

Calculate fertilizer for back yard.

50 x 75 = 3,750

$$\text{Fertilizer} = \frac{1}{0.15} \times \frac{3{,}750}{1{,}000}$$

$$= 6.667 \times 3.750$$

= 25 pounds of 15-2-15

The Bottom Line – Do's

Do:

- Read the fertilizer tag before purchasing a product.
- Follow UF/IFAS recommendations.
- Fertilize "as needed" according to the age (self-sufficiency) of plants.
- Be mindful of the pest, maintenance, and environmental problems caused by excess nitrogen and phosphorus.
- Use fertilizers containing slow- or controlled-release N and low P.
- Use compost and organic mulch to increase the nutrient holding ability of soil.
- Keep fertilizer off of hard surfaces.

The Bottom Line

Don’t:

- Don’t fertilize established trees and shrubs surrounded by fertilized lawn.
- Don’t try to correct a deficiency with a complete fertilizer - just apply the missing nutrient(s).
- Don’t use combination products e.g., “weed and feed.”
- Don’t “deep root feed” (inject fertilizers) except on slopes where it could run off.
- Don’t apply fertilizer when heavy rain is predicted.
- Don’t use fertilizer to overcome poor growth associated with too much shade.

Activity #2
Comparing Fertilizers

- Break up into groups of 3-4.
- Complete the fertilizer comparison sheet in the Student Handbook.
- Discuss the answers as a class.

Acknowledgements

- Contributors: Dr. Amy Shober, Former UF/IFAS Soil Specialist; Dr. Jerry Kidder, Retired UF/IFAS Soil Specialist; Larry Figart, UF/IFAS Urban Forestry Agent Duval County
- Reviewers: Dr. Travis Shaddox, Asst. Professor, UF/IFAS Ft. Lauderdale Research and Education Center; Terry Delvalle, Urban Horticulture Agent, Duval County Extension; Mary Salinas, Urban Horticulture Agent, Santa Rosa County Extension; Joe Sewards, Urban Horticulture Agent, Volusia County Extension
- Sydney Park Brown, CLCE, (2018 Revision)
- Texas Master Gardener Manual: Chapter 2